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(REV 11-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

## TRANSMITTAL LETTER TO THE UNITED STATES

102126--(320)

DESIGNATED/ELECTED OFFICE (DO/EO/US)

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

CONCERNING A FILING UNDER 35 U.S.C. 371

10/018278

INTERNATIONAL APPLICATION NO.

INTERNATIONAL FILING DATE

PRIORITY DATE CLAIMED

PCT/DE00/01798

31 May 2000 (31.05.00)

17 June 1999 (17.06.99)

## TITLE OF INVENTION

**Method and Device for Demounting/Remounting Hammers, Hammer Axles and/or Protective Caps of Rotors of Hammer Crushers**

APPLICANT(S) FOR DO/EO/US

**Martin HASSLER**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
  - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
  - b. ☒ has been communicated by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
  - a. ☐ is attached hereto.
  - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
  - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
  - b. ☐ have been communicated by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A copy of the International Search Report (PCT/ISA/210).

**Items 13 to 20 below concern document(s) or information included:**

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☒ Certificate of Mailing by Express Mail
23. ☒ Other items or information:

**Application Data Sheet**

10018278-040202

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.101) <b>10/018278</b>		INTERNATIONAL APPLICATION NO. <b>PCT/DE00/01798</b>		ATTORNEY'S DOCKET NUMBER <b>102126--(320)</b>	
24. The following fees are submitted:.				<b>CALCULATIONS PTO USE ONLY</b>	
<b>BASIC NATIONAL FEE ( 37 CFR 1.492 (a) (1) - (5) ) :</b> <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... <b>\$1040.00</b> <input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... <b>\$890.00</b> <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$740.00</b> <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... <b>\$710.00</b> <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... <b>\$100.00</b> <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>				<b>\$890.00</b>	
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).				<b>\$0.00</b>	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =	0	x \$18.00	<b>\$0.00</b>	
Independent claims	- 3 =	0	x \$84.00	<b>\$0.00</b>	
Multiple Dependent Claims (check if applicable).				<input type="checkbox"/> <b>\$0.00</b>	
<b>TOTAL OF ABOVE CALCULATIONS =</b>				<b>\$890.00</b>	
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				<b>\$445.00</b>	
<b>SUBTOTAL =</b>				<b>\$445.00</b>	
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).				<b>\$0.00</b>	
<b>TOTAL NATIONAL FEE =</b>				<b>\$445.00</b>	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).				<input type="checkbox"/> <b>\$0.00</b>	
<b>TOTAL FEES ENCLOSED =</b>				<b>\$445.00</b>	
				Amount to be: refunded	\$
				charged	\$

- a. ☐ A check in the amount of \_\_\_\_\_ to cover the above fees is enclosed.
- b. ☒ Please charge my Deposit Account No. 14-1263 in the amount of \$445.00 to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-1263. A duplicate copy of this sheet is enclosed.
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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*Christa Hildebrand*  
 SIGNATURE

**Christa Hildebrand**  
 NAME

**34,953**  
 REGISTRATION NUMBER

**December 14, 2001**  
 DATE

**CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10)**Applicant(s): **Martin HASSLER**

Docket No.

102126--(320)

Serial No.

TBA

Filing Date

Concurrently Herewith

Examiner

TBA

Group Art Unit

TBA

10/018278

Invention:

**Method and Device for Demounting/Remounting Hammers, Hammer Axles and/or Protective Caps of Rotors of Hammer Crushers**

I hereby certify that the following correspondence:

U.S.national stage application of PCT/DE00/01798

*(Identify type of correspondence)*

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: The Assistant Commissioner for Patents, Washington, D.C. 20231 on

**December 14, 2001***(Date)***Kathleen D. Monical***(Typed or Printed Name of Person Mailing Correspondence)**(Signature of Person Mailing Correspondence)***EV 015941124 US***("Express Mail" Mailing Label Number)***Note: Each paper must have its own certificate of mailing.**

CERTIFICATE OF MAILING

I hereby certify that this paper and every paper referred to therein as being enclosed is being deposited with the U.S. Postal Service "Express Mail Post Office to Addressee" service, postage prepaid, in an envelope addressed to: Asst, Commissioner of Patents, Box PCT, Washington, DC 20231, Express Mailing Label No. EV 015942500 US

4/2/02  
Date

*Kathleen D. Monical*  
Kathleen D. Monical

Attorney Docket: 102126-4

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Martin HASSLER

SERIAL NO.: 10/018,278

INTERN. FILING: June 13, 2000

FOR: **Method and Device for Demounting/Remounting Hammers, Hammer Axles and/or Protective Caps of Rotors of Hammer Crushers**

ART UNIT: TO BE ASSIGNED

EXAMINER: TO BE ASSIGNED

-----  
Hon. Assistant Commissioner of Patents  
Washington, DC 20231

**PRELIMINARY AMENDMENT**

Sir:

Prior to examination, please amend the application as follows:

**IN THE SPECIFICATION:**

Please amend the specification pursuant to 37 CFR 1.121 as follows (a "marked up" version pursuant to 1.121 is attached):

*Page 1, line 4, replace with the following:*

**BACKGROUND OF THE INVENTION**

**Field of the Invention**

*Page 1, line 11, replace with the following:*

**Description of the Related Art**

*Page 3, line 31, replace with the following:*

**Detailed Description of the Presently Preferred Embodiments**

*Page 7, third full paragraph, please replace with*

The releasable connection in process step e) is established by rotating the locking lever 2.6 and the fixing elements 2.3 of the cross member 2.1, which are formed as hammer head screws and secured with nuts 2.7, and engaging the same behind the fixing elements 1.6 of the rotor, which are formed as openings or slots, whereby the cross member 2.1 is affixed to the rotor 1.

*Page 7, last line, please add the following paragraph:*

As stated above, the invention also provides for a device for carrying out the method as described above having a drive unit (2.8) connected to a lockable slide (2.4), with the drive unit (2.8) including a cross member (2.1) with fixing elements (2.3) for attachment to a rotor (1) of a hammer crusher (not shown). Both, the slide (2.4) and the cross member (2.1) and the drive unit (2.8) can move relative to the rotor (1) and relative to one another. A pulling head (2.2) is affixed on the hammer axle (1.5) and connected to the slide (2.4) so as to be capable of assuming several relative positions thereto. The drive unit (2.8) is made of two hydraulic cylinders (2.8.1, 2.8.2) which are affixed on the slide (2.4) and whose piston rods (2.8.3, 2.8.4) are connected by the cross member (2.1). The drive unit (2.8) comprises an electric motor with a spindle, and the spindle is connected to the cross member (2.1) by a threaded element. The cross member (2.1) has hammer head screws, forming fixing elements (2.3), which engage in corresponding slots or openings (1.6) of an end disk (1.2) or a similar element of the rotor (1), which through rotation by locking levers (2.6) engage behind the end disk (1.2)

and are secured by nuts (2.7), wherein in this position the cross member (2.1) is in a rigid and releasable connection with the rotor (1). The pulling head (2.2) is connected to the slide (2.4) by a releasable element (2.5), such as an insertable interlocking element. The releasable element (2.5) can lock the pulling head (2.2) on the slide (2.4) in several spacings/positions and that the slide (2.4) has several suitable insertion positions therefor. When the piston rods (2.8.3, 2.8.4) are retracted, the slide (2.4) is arranged at a spacing in the axial direction of the rotor (1) which corresponds to the length of the respective hammer axle (1.5) plus tolerances, divided by the required or desired number of strokes for pulling the hammer axle (1.5), whereby the respective position assumed by the slide (2.4) is locked by the releasable element (2.5). The hammer axle (1.5), after having been completely pulled out, rests in the slide (2.4) and can optionally be exchanged against a new hammer axle (1.5), wherein its placement corresponds to the demounting and/or mounting position in the rotor (1) and the features recited in claims 6 to 12 are also applicable to the installation of the hammer axles (1.5).

*Page 9, delete entirely*

#### **IN THE CLAIMS:**

Please cancel claims 1 -13 and add new claims 14- 26.

--14 (new) A method for demounting and remounting of at least one of a plurality of hammers, hammer axles and protective caps of a rotor of a hammer crusher by utilizing a hammer axle pulling device , comprising the steps of

- a) exposing the rotor (1), which remains mounted in at least part of the housing, and rotating and securing the rotor in an upper dead center position of the respective hammer axle (1.5);
- b) affixing a pulling head (2.2) on an exposed end of the hammer axle (1.5);
- c) mounting a cross member (2.1) with a plurality of first fixing elements (2.3) of a hammer axle pulling device (2) in a position in which the fixing elements (2.3) match corresponding second fixing elements (1.6) on a front face of the rotor (1);
- d) pulling a releasable element (2.5) of a slide (2.4) of the hammer axle pulling

- device (2) and keeping said releasable element (2.5) available;
- e) producing a rigid and subsequently releasable connection between the fixing elements (2.3) of the cross member (2.1) and the fixing elements (1.6) of the rotor (1);
  - f) advancing the slide (2.4) of the hammer axle pulling device (2) to a first position in which the pulling head (2.2) affixed on the hammer axle (1.5) is connected to the slide (2.4) with a positive fit by means of the releasable element (2.5) ;
  - g) securing the position of the hammers (1.3) and optionally, of the protective caps (1.4);
  - h) retracting the slide (2.4) of the hammer axle pulling device (2) and simultaneously pulling the hammer axle (1.5) out to a first position in which at least one of the hammers (1.3) or one of the protective cap (1.4) can be removed freely;
  - i) releasing the releasable connection between the pulling head (2.2) and the slide (2.4) using the releasable element (2.5);
  - j) advancing the slide (2.4) to a second position in which the pulling head (2.2) is again connected to the slide (2.4) with a positive fit;
  - k) retracting the slide (2.4) and pulling the hammer axle (1.5) out to a position in which all hammers (1.3) and/or protective caps (1.4) and optionally the hammer axle (1.5) are removed, for finishing the demounting step;
  - l) remounting by initially advancing the slide (2.4) connected to the new hammer axle (1.5), while subsequently reversing the order of the steps b) to k), and reversing the corresponding operational steps from the installation of the hammers (1.3) and/or protective caps (1.4) to the release of the fixing elements (2.3) of the cross member (2.1) of the slide (2.4) from the fixing elements (1.6) of the rotor (1) and removal of the cross member (2.1) by retracting the slide (2.4), and releasing the attachment of the pulling head (2.2) to the hammer axle (1.5) and placing the rotor (1) in the ready state for the comminution process.

15. (New) The method of claim 14, wherein steps a) to l) are repeated according to the remaining number of hammer axles (1.5) to be exchanged in the rotor (1) and/or the

hammers (1.3) and/or protective caps (1.4).

16. (New) The method of claim 14, further comprising the step of releasing/remounting a locking element that secures the hammer axle (1.5) on the rotor (1).

17. (New) The method according to claim 14, wherein in process step e) the releasable connection with locking lever (2.6) secured by nuts (2.7) is established by rotating the fixing elements (2.3) of the cross member (2.1), which are formed as hammer head screws, and by engaging the same behind the fixing elements (1.6) of the rotor (1), which are formed as openings or slots, whereby the cross member (2.1) is affixed to the rotor (1).

18. (New) The method according to claim 14, wherein, during a phase where a hammer (1.3) and/or a protective cap (1.4) can be demounted, a partially worn-out element (1.3, 1.4) can be remounted in the opposite effective direction by rotating the element 180°.

19. (New) A device for demounting and remounting of at least one of a plurality of hammers, hammer axles and protective caps of a rotor of a hammer crusher, comprising  
a drive unit (2.8) connected to a lockable slide (2.4), with the drive unit (2.8) including a cross member (2.1) with fixing elements (2.3) for attachment to a rotor (1) of a hammer crusher (not shown), wherein both the entire slide (2.4) as well as the cross member (2.1) and the drive unit (2.8) can move relative to the rotor (1) and relative to one another, a pulling head (2.2) which is, on one hand, affixed on the hammer axle (1.5) and, on the other hand, connected to the slide (2.4) so as to be capable of assuming several relative positions thereto.

20. (New) The device of claim 19, wherein the drive unit (2.8) is made of two hydraulic cylinders (2.8.1, 2.8.2) which are affixed on the slide (2.4) and whose piston rods (2.8.3, 2.8.4) are connected by the cross member (2.1).



21. (New) The device of claim 19, wherein the drive unit (2.8) comprises an electric motor with a spindle, wherein the spindle is connected to the cross member (2.1) by a threaded element.

22. (New) The device according to claim 19, wherein the cross member (2.1) has hammer head screws forming fixing elements (2.3), which engage in corresponding slots or openings (1.6) of an end disk (1.2) or a similar element of the rotor (1), which through rotation by locking levers (2.6) engage behind the end disk (1.2) and are secured by nuts (2.7), wherein in this position the cross member (2.1) is in a rigid and releasable connection with the rotor (1).

23. (New) The device according to claim 19, wherein the pulling head (2.2) is connected to the slide (2.4) by a releasable element (2.5), such as an insertable interlocking element.

24. (New) The device according to claim 19, wherein the releasable element (2.5) can lock the pulling head (2.2) on the slide (2.4) in several spacings/positions and wherein the slide (2.4) has several suitable insertion positions therefor.

25. (New) The device of claim 19, wherein, when the piston rods (2.8.3, 2.8.4) are retracted, the slide (2.4) is arranged at a spacing in the axial direction of the rotor (1) which corresponds to the length of the respective hammer axle (1.5) plus tolerances, divided by the required or desired number of strokes for pulling the hammer axle (1.5), whereby the respective position assumed by the slide (2.4) is locked by the releasable element (2.5).

26. (New) The device according to claim 19, wherein the hammer axle (1.5), after having been completely pulled out, rests in the slide (2.4) and is capable of being exchanged against a new hammer axle (1.5), wherein its placement corresponds to the demounting and/or mounting position in the rotor (1). --

*On a new page, please add the following Abstract*


## **ABSTRACT**

A method and apparatus involving releasing the rotor (1) and turning it to and fixing it at top dead center, attaching an extractor head to an exposed end of the hammer axle. A cross-piece (2.1) is applied and a releasable element of a carriage (2.4) of a hammer axle puller is pulled, making a releasable connection between cross-piece and rotor attachment elements. The carriage is moved to a position in which the puller head is connected to the carriage in a shape-locking manner, securing the hammer position, returning the carriage whilst extracting the hammer axle (1.5) to release the hammer. The connection between the head and carriage is released, moving the carriage until the head and carriage re-engage and returning the carriage again to extract the hammer axle until the entire hammer and/or protective cap (1.4) and axle if appropriate are extracted. An Independent claim is also included for an arrangement for implementing the method.

**REMARKS**

The above amendments were made to place the application into proper U.S. patent format. Early and favorable consideration is earnestly solicited.

Respectfully submitted,  
NORRIS MCLAUGHLIN & MARCUS, P.A.

By   
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**MARK-UP FOR PRELIMINARY AMENDMENT**  
**PURSUANT TO 37 C.F.R. § 1.121**

Hon. Assistant Commissioner of Patents  
Washington, DC 20231

Specification:

*Page 1, line 4:*

[Field of technology] **BACKGROUND OF THE INVENTION**

**Field of Invention**

*Page 1, line 11:*

[State of the technology] **Description of the Related Art**

*Page 3, line 31:*

[Best mode for carrying out the invention] **Detailed Description of the Presently Preferred Embodiments**

*Page 7, lines 22-26:*

The releasable connection in process step [c)] e) is established by rotating the locking lever 2.6 and the fixing elements 2.3 of the cross member 2.1, which are formed as hammer head screws and secured with nuts 2.7, and engaging the same behind the fixing elements 1.6 of the rotor, which are formed as openings or slots, whereby the cross member 2.1 is affixed to the rotor 1.

*Page 7, after line 30, please add the following paragraph:*

As stated above, the invention also provides for a device for carrying out the method as described above having a drive unit (2.8) connected to a lockable slide (2.4), with the

drive unit (2.8) including a cross member (2.1) with fixing elements (2.3) for attachment to a rotor (1) of a hammer crusher (not shown). Both, the slide (2.4) and the cross member (2.1) and the drive unit (2.8) can move relative to the rotor (1) and relative to one another. A pulling head (2.2) is affixed on the hammer axle (1.5) and connected to the slide (2.4) so as to be capable of assuming several relative positions thereto. The drive unit (2.8) is made of two hydraulic cylinders (2.8.1, 2.8.2) which are affixed on the slide (2.4) and whose piston rods (2.8.3, 2.8.4) are connected by the cross member (2.1). The drive unit (2.8) comprises an electric motor with a spindle, and the spindle is connected to the cross member (2.1) by a threaded element. The cross member (2.1) has hammer head screws, forming fixing elements (2.3), which engage in corresponding slots or openings (1.6) of an end disk (1.2) or a similar element of the rotor (1), which through rotation by locking levers (2.6) engage behind the end disk (1.2) and are secured by nuts (2.7), wherein in this position the cross member (2.1) is in a rigid and releasable connection with the rotor (1). The pulling head (2.2) is connected to the slide (2.4) by a releasable element (2.5), such as an insertable interlocking element. The releasable element (2.5) can lock the pulling head (2.2) on the slide (2.4) in several spacings/positions and that the slide (2.4) has several suitable insertion positions therefor. When the piston rods (2.8.3, 2.8.4) are retracted, the slide (2.4) is arranged at a spacing in the axial direction of the rotor (1) which corresponds to the length of the respective hammer axle (1.5) plus tolerances, divided by the required or desired number of strokes for pulling the hammer axle (1.5), whereby the respective position assumed by the slide (2.4) is locked by the releasable element (2.5). The hammer axle (1.5), after having been completely pulled out, rests in the slide (2.4) and can optionally be exchanged against a new hammer axle (1.5), wherein its placement corresponds to the demounting and/or mounting position in the rotor (1) and the features recited in claims 6 to 12 are also applicable to the installation of the hammer axles (1.5).

00008593

**Method and device for demounting/remounting hammers, hammer axles  
and/or protective caps of rotors of hammer crushers**

**Field of technology**

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The invention relates to a method and device for demounting/remounting hammers, hammer axles and/or protective caps of the rotors of hammer crushers, which are used in particular for comminuting of generally metallic scrap.

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**State of the technology**

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Hammer crushers consist essentially of a housing with a rotor supported in the housing, with the rotor composed of a plurality of disks or spiders which are non-rotatably disposed on a shaft and hammers distributed between them. The hammers are rotatably supported on hammer axes that extend through the disks in a parallel-eccentric relationship to the shaft, wherein the hammer axes also hold protective caps which cover the rotor to protect the rotor against wear.

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In the comminution process, the rotor and in particular the hammers, protective caps and the hammer axes holding the caps are subjected to the different wear conditions.

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At least during the so-called maintenance intervals, wear may require that the spent hammers and/or protective caps are replaced by new ones. This is done by driving, pulling or pressing the hammer axes out of their seat in the disks or spiders.

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For this purpose, devices with, for example, a hydraulic drive are used which represent an independent unit that can only be used during maintenance, but has otherwise no connection with the actual operation of the hammer crusher.

Depending its operating mode, design and efficiency, such device which is frequency referred to as a hammer axle pulling device, is important not only for of changing hammers and protective caps the hammer crusher, but also for an the increased uptime of the hammer crusher.

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Pulling the hammer axles can be difficult because the hammer axles are not only subjected to frictional wear, but also experience significant upsetting deformation. Accordingly, the hammer axles may have to be driven with very large forces through the bores of the disks or spiders, meaning that after its useful operating life, the respective hammer axle has both smaller and larger diameters as compared to the original manufacturing dimensions.

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The hammer axle pulling devices used to this date consists primarily of a moveable frame that can be moved manually, connecting rods secured to the frame and moveable thereto, which require significant space and are of complex design, so that the required maintenance has an unfavorable effect on the uptime of the hammer crusher system.

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### **Summary of the invention**

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It is therefore the object of the invention to provide a method and a device, which simplifies demounting and remounting of hammers, hammer axles and/or protective caps in hammer crushers by eliminating the need for cross members and allowing a compact design of the device, by reducing manufacturing cost and by altering the sequence of steps required for demounting and remounting with the method to increase the uptime of the hammer crusher through reduced maintenance times.

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This is solved by the invention by the characterizing features of claims 1 to 13.

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The overall advantages of the invention and solution to the aforescribed object

of the invention are based on the fact that the method with the device can eliminate the use of pulling rods which reduces the required space for the pulling operation, so that the working platforms surrounding the hammer crusher, buildings and/or sound proofing walls can be set up closer to the hammer axle pulling device. Moreover, the drive can move the cross member close to the rotor, without requiring extensive manual labor for moving a carriage. Finally, the compact construction reduces manufacturing cost and investment expenses for building a hammer crusher, and the operating mode according to the invention increases the uptime of a hammer crusher plant.

### **Brief description of the drawings**

The invention will be described in more detail with reference to an embodiment. The corresponding drawings show in

Fig. 1 a schematic diagram of the process flow and the construction of the invention with the functions

- a) hammer axle pulling device in ready mode,
- b) establishing the connection between cross member and the rotor,
- c) pulling to the hammer axle in 3 strokes,

Fig. 2 the basic construction of the hammer axle pulling device with a hydraulic drive in releaseable effective connection to the rotor of the hammer crusher shown in a longitudinal cross-sectional view, and

Fig. 3 a front view of the rotor of Fig. 2, initially without the features of the hammer axle pulling device, wherein the detailed view A-A shows the section taken along the line A-A of Fig. 2, with the section taken along B-B shown as detail B-B.

### **Best mode for carrying out the invention**



To provide a better understanding of the technological and constructive relationships, a rotor 1 supported in a housing (not shown) of a hammer crusher will be described first with reference to Figs. 2 and 3. The rotor is made of several disks 1.2 or spiders that are non-rotatably disposed on a shaft 1.1, and of hammers 1.3 distributed between them, wherein the hammers 1.3 are rotatably supported on hammer axles 1.5 that are guided through the disks 1.2 parallel to and eccentrically with respect to the shaft 1.1. The hammer axles 1.5 also hold protective caps 1.4 which protect the rotor 1 and the disks 1.2 against wear. The hammer axles 1.5 are secured in the axial direction with releaseable locking elements 1.7 which are affixed to the outer disks 1.2. Finally, openings, such as slots 1.6, which form corresponding attachment elements for a hammer axle pulling device 2 depicted in Fig. 1, are provided on the outer disks 1.2 to allow demounting and remounting of the hammers 1.3, hammer axles 1.5 and protective caps, as described above.

The hammer axle pulling device 2 according to the invention consists of a drive unit 2.8 which is connected to a lockable moveable slide 2.4 that can be moved on an anchored rail frame 2.9. The drive unit 2.8 has a cross member 2.1 with fixing elements 2.3, such as hammer head bolts, which engage with or engage behind the aforescribed openings 1.6. Both the entire slide 2.4 and the cross member 2.1 can move relative to one another and to the rotor 1. A pulling head 2.2 is affixed, on one hand, on the hammer axle 1.5 after removal of the locking element 1.7 and, on the other hand, connected to the slide 2.4 for arrangement in several relative positions thereto.

The drive unit 2.8 consists of two hydraulic cylinders 2.8.1, 2.8.2 which are affixed to the slide 2.4 and include piston rods 2.8.3, 2.8.4 that are connected by the cross member 2.1. Alternatively, the drive unit 2.8 can also consists of an electric motor (not shown) with a spindle, whereby the spindle is connected to the cross member 2.1 by a threaded element.

The cross member 2.1 includes as fixing elements 2.3 the aforementioned hammer head screws, which engage in the corresponding slots or openings 1.6 of the end disks 1.2 or of a similar element of the rotor 1. The hammer head screws engage behind the end disks 1.2 by being rotated with locking levers 2.6 and are secured by nuts 2.7 (Fig. 3, B-B). In this position, the cross member 2.1 is in a fixed and releaseable connection with the rotor 1.

The pulling head 2.2 is connected with the slide 2.4 by a releaseable element 2.5, such as an insertable interlocking device, whereby the pulling head 2.2 can be locked on the slide 2.4 in several spacings/positions (Fig. 3, A-A). For this purpose, the slide 2.4 has several suitable insertion positions.

When the piston rods 2.8.3, 2.8.4 (Fig. 1a) are retracted, the slide 2.4 is arranged at such a spacing in the axial direction of the rotor 1 and locked on the anchored rail frame 2.9 that the spacing corresponds to the length of the respective hammer axle 1.5 plus tolerances, divided by the required or desired number of strokes (Fig. 1c) for pulling the hammer axle 1.5. The resulting position of the slide 2.4 is locked in position by the releaseable element 2.5 (Fig. 1b).

As a result, the hammer axle pulling device 2 is constructed so that the hammer axle 1.5, after having been completely pulled, rests in the slide 2.4 and can optionally be exchanged against a new hammer axle 1.5, with its position corresponding to the demounting and remounting position relative to the rotor 1.

It will be understood that the axle pulling device 2 implemented in this way can also be used for installing the hammer axles 1.5.

The method of the invention for demounting and remounting of hammers 1.3, hammer axles 1.5 and/or protective caps 1.4 during a repair using the hammer axle pulling device 2 is implemented by carrying out the following process steps:

- a) exposing the rotor 1, which remains mounted in at least one part of the housing, and rotating and securing the same in an upper dead center position of the respective hammer axle 1.5;
- 5 b) affixing a pulling head 2.2 on an exposed end of the hammer axle 1.5 (Fig. 1b);
- c) mounting a cross member 2.1 with fixing elements **2.2** of a hammer axle pulling device 2 in a position in which the fixing elements 2.3 match corresponding fixing elements 1.6 on a front face of the rotor 1 (Fig. 2, Fig. 10 3 A-A, B-B);
- d) pulling a releasable element 2.5 of a slide 2.4 of the hammer axle pulling device 2 and keeping said releasable element 2.5 available;
- e) producing a rigid and subsequently releasable connection between the fixing elements 2.3 of the cross member 2.1 and the fixing elements 1.6 of the rotor 1 (Fig. 3 B-B);
- 15 f) advancing the slide 2.4 of the hammer axle pulling device 2 to a position in which the pulling head 2.2 affixed on the hammer axle 1.5 is connected to the slide 2.4 with a positive fit by means of the releasable element 2.5 that is provided (Fig. 1b);
- 20 g) securing the position of the hammers 1.3 and optionally, of the protective caps 1.4;
- h) retracting the slide 2.4 of the hammer axle pulling device 2 and simultaneously pulling the hammer axle 1.5 out to a first position in which at least one hammer 1.3 and/or optionally, a protective cap 1.4 can be removed freely (Fig. 1c, 1/3 stroke);
- 25 i) releasing the releasable connection between the pulling head 2.2 and the slide 2.4 using the releasable element 2.5;
- j) once more, advancing the slide 2.4 to another position in which the pulling head 2.2 is again connected to the slide (2.4) with a positive fit;
- 30 k) once again, and optionally repeatedly, retracting the slide 2.4 and pulling the hammer axle 1.5 out to a position in which all hammers 1.3 and/or

protective caps 1.4 and optionally the hammer axle 1.5 are removed,  
thereby finishing the demounting step (Fig. 1c, 2/3 stroke, 3/3 stroke);  
thereafter remounting by

- 5 l) initially advancing the slide 2.4 connected to the new hammer axle 1.5,  
while subsequently reversing the order of the steps b) to k), as well as  
reversing the corresponding operational steps from the installation of the  
hammers 1.3 and/or protective caps 1.4 to the release of the fixing  
elements 2.3 of the cross member 2.1 of the slide 2.4 from the fixing  
elements 1.6 of the rotor 1 and removal of the cross member 2.1 by  
10 retracting the slide 2.4, as well as releasing attachment of the pulling head  
2.2 with the hammer axle 1.5 and placing the rotor in the ready state for  
the comminution process.

15 The steps a) to l) are repeated depending on the remaining number of hammer  
axes 1.5 to be replaced in the rotor 1 and/or the number of the hammers 1.3  
and/or protective caps 1.4 to be replaced.

20 It should be noted in the process flow that the blocking element 1.7 that secures  
the hammer axle 1.5 is first released and then reinstalled after the remounting  
operation is complete.

25 The releasable connection in process step c) is established by rotating the  
locking lever 2.6 and the fixing elements 2.3 of the cross member 2.1, which are  
formed as hammer head screws and secured with nuts 2.7, and engaging the  
same behind the fixing elements 1.6 of the rotor, which are formed as openings  
or slots, whereby the cross member 2.1 is affixed to the rotor 1.

30 The process flow can also include that during a demounting phase of a hammer  
1.3 and/or a protective cap 1.4 the respective element 1.3, 1.4 can be remounted  
in case of a partial wear by rotating them 180° in the opposite effective direction.

### **Industrial applicability**

The invention has industrial applicability because demounting and remounting require only a small clearance, the peripheral devices can be installed closer to  
5 the more compact hammer crusher system, so that the function according to the invention facilitates repair and increases the availability of the system.

## List of reference numerals

	1	=	rotor
	1.1	=	shaft
5	1.2	=	disk
	1.3	=	hammer
	1.4	=	protective camp
	1.5	=	hammer axle
	1.6	=	fixing elements, opening, slot
10	1.7	=	locking element
	2	=	hammer axle pulling device
	2.1	=	cross member
	2.2	=	pulling head
	2.3	=	fixing element, hammer head screw
15	2.4	=	slide
	2.5	=	releasable element, blocked
	2.6	=	locking lever
	2.7	=	nut
	2.8	=	drive unit
20	2.8.1	=	hydraulic cylinder
	2.8.2	=	hydraulic cylinder
	2.8.3	=	piston rod
	2.8.4	=	piston rod
	2.9	=	rail frame

25

## Claims

1. Method for demounting and remounting of hammers (1.3), hammer axles (1.5) and/or protective caps (1.4) of rotors (1) of hammer crushers with the help of a hammer axle pulling device (2), comprising the steps
- a) exposing the rotor (1), which remains mounted in at least one part of the housing, and rotating and securing the same in an upper dead center position of the respective hammer axle (1.5);
  - b) affixing a pulling head (2.2) on an exposed end of the hammer axle (1.5) (Fig. 1b);
  - c) mounting a cross member (2.1) with fixing elements (2.2) of a hammer axle pulling device (2) in a position in which the fixing elements (2.3) match corresponding fixing elements (1.6) on a front face of the rotor (1) (Fig. 2, Fig. 3 A-A, B-B);
  - d) pulling a releasable element (2.5) of a slide (2.4) of the hammer axle pulling device (2) and keeping said releasable element (2.5) available;
  - e) producing a rigid and subsequently releasable connection between the fixing elements (2.3) of the cross member (2.1) and the fixing elements (1.6) of the rotor (1) (Fig. 3 B-B);
  - f) advancing the slide (2.4) of the hammer axle pulling device (2) to a position in which the pulling head (2.2) affixed on the hammer axle (1.5) is connected to the slide (2.4) with a positive fit by means of the releasable element (2.5) that is provided (Fig. 1b);
  - g) securing the position of the hammers (1.3) and optionally, of the protective caps (1.4);
  - h) retracting the slide (2.4) of the hammer axle pulling device (2) and simultaneously pulling the hammer axle (1.5) out to a first position in which at least one hammer (1.3) and/or optionally, a protective cap (1.4) can be removed freely (Fig. 1c, 1/3 stroke);
  - i) releasing the releasable connection between the pulling head (2.2) and the slide (2.4) using the releasable element (2.5);

- j) once more, advancing the slide (2.4) to another position in which the pulling head (2.2) is again connected to the slide (2.4) with a positive fit;
- k) once again, and optionally repeatedly, retracting the slide (2.4) and pulling the hammer axle (1.5) out to a position in which all hammers (1.3) and/or protective caps (1.4) and optionally the hammer axle (1.5) are removed, thereby finishing the demounting step (Fig. 1c, 2/3 stroke, 3/3 stroke);

thereafter remounting by

- l) initially advancing the slide (2.4) connected to the new hammer axle (1.5), while subsequently reversing the order of the steps b) to k), as well as reversing the corresponding operational steps from the installation of the hammers (1.3) and/or protective caps (1.4) to the release of the fixing elements (2.3) of the cross member (2.1) of the slide (2.4) from the fixing elements (1.6) of the rotor (1) and removal of the cross member (2.1) by retracting the slide (2.4), as well as releasing the attachment of the pulling head (2.2) to the hammer axle (1.5) and placing the rotor (1) in the ready state for the comminution process.

2. The method of claim 1, **characterized by** repeating the steps a) to l) according to the remaining number of hammer axles (1.5) to be exchanged in the rotor (1) and/or the hammers (1.3) and/or protective caps (1.4) to be replaced.

3. The method of claim 1, **characterized by** releasing/remounting a locking element (1.7) that secures the hammer axle (1.5) on the rotor (1).

4. The method according to one of the claims 1 to 3, **characterized in** that in process step e) the releasable connection with locking lever (2.6) secured by nuts (2.7) is established by rotating the fixing elements (2.3) of the cross member (2.1), which are formed as hammer head screws, and by engaging the same behind the fixing elements (1.6) of the rotor (1), which are formed as openings or slots, whereby the cross member (2.1) is affixed to the rotor (1).



5. The method according to one of the claims 1 to 4, **characterized in** that during a phase where a hammer (1.3) and/or a protective cap (1.4) can be demounted, a partially worn-out element (1.3, 1.4) can be remounted in the opposite effective direction by rotating the element 180°.

5

6. Device for carrying out the method, comprising a drive unit (2.8) connected to a lockable slide (2.4), with the drive unit (2.8) including a cross member (2.1) with fixing elements (2.3) for attachment to a rotor (1) of a hammer crusher (not shown), wherein both the entire slide (2.4) as well as the cross member (2.1) and the drive unit (2.8) can move relative to the rotor (1) and relative to one another, a pulling head (2.2) which is, on one hand, affixed on the hammer axle (1.5) and, on the other hand, connected to the slide (2.4) so as to be capable of assuming several relative positions thereto.

7. The device of claim 6, **characterized in** that the drive unit (2.8) is made of two hydraulic cylinders (2.8.1, 2.8.2) which are affixed on the slide (2.4) and whose piston rods (2.8.3, 2.8.4) are connected by the cross member (2.1).

8. The device of claim 6, **characterized in** that the drive unit (2.8) comprises essentially an electric motor with a spindle, wherein the spindle is connected to the cross member (2.1) by a threaded element.

9. The device according to one of the claims 6 to 8, **characterized in** that the cross member (2.1) has hammer head screws forming fixing elements (2.3), which engage in corresponding slots or openings (1.6) of an end disk (1.2) or a similar element of the rotor (1), which through rotation by locking levers (2.6) engage behind the end disk (1.2) and are secured by nuts (2.7), wherein in this position the cross member (2.1) is in a rigid and releasable connection with the rotor (1).

30

10. The device according to one of the claims 6 to 9, **characterized in** that the

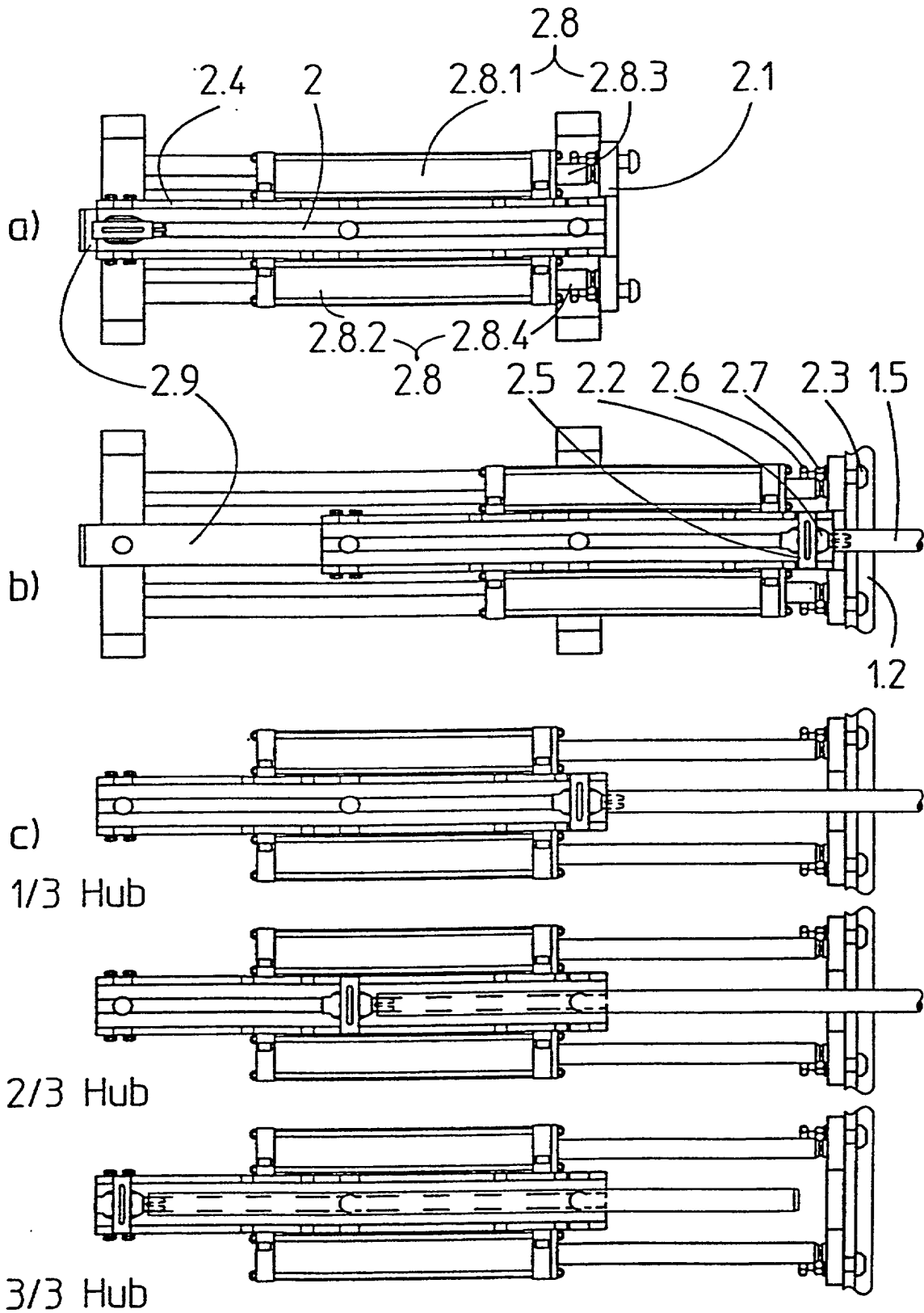
pulling head (2.2) is connected to the slide (2.4) by a releasable element (2.5), such as an insertable interlocking element.

11. The device according to one of the claims 6 to 10, **characterized in** that the  
5 releasable element (2.5) can lock the pulling head (2.2) on the slide (2.4) in several spacings/positions and that the slide (2.4) has several suitable insertion positions therefor.

12. The device of claim 7, **characterized in** that when the piston rods (2.8.3,  
10 2.8.4) are retracted, the slide (2.4) is arranged at a spacing in the axial direction of the rotor (1) which corresponds to the length of the respective hammer axle (1.5) plus tolerances, divided by the required or desired number of strokes for pulling the hammer axle (1.5), whereby the respective position assumed by the slide (2.4) is locked by the releasable element (2.5).

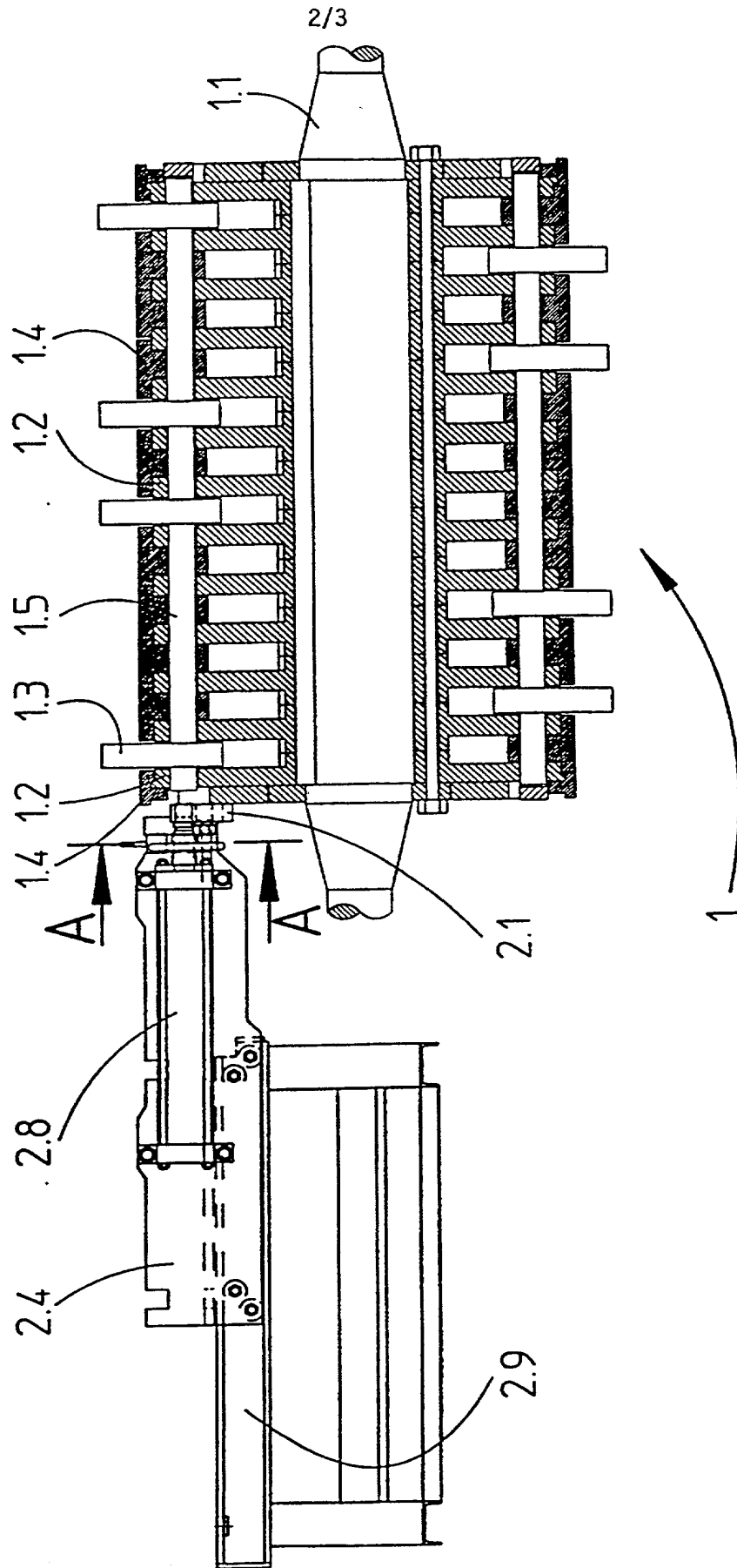
13. The device according to one of the claims 6 to 12, **characterized in** that the  
15 hammer axle (1.5), after having been completely pulled out, rests in the slide (2.4) and can optionally be exchanged against a new hammer axle (1.5), wherein its placement corresponds to the demounting and/or mounting position in the  
20 rotor (1) and the features recited in claims 6 to 12 are also applicable to the installation of the hammer axles (1.5).

1/3  
Fig. 1

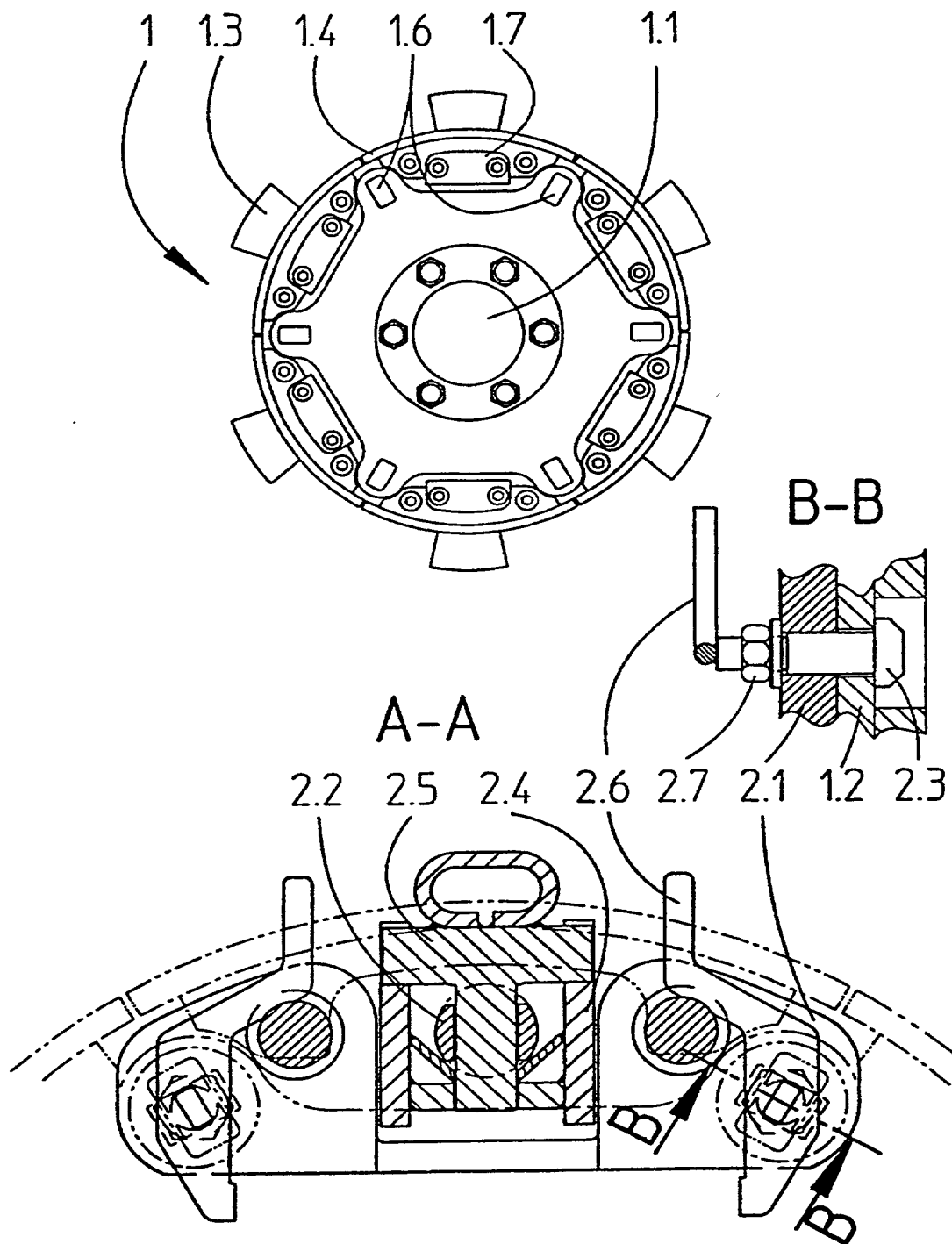


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Fig. 2



3/3  
Fig. 3



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If each inventor understands English, the Declaration and Power of Attorney below is suitable for use when filing a regular patent application and also when entering the national stage, in the case of an International application designating the USA under the PCT.

COMBINED DECLARATION AND POWER OF ATTORNEY FOR  
PATENT APPLICATION

Attorney Docket No.  
102126-4

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below at 201) or an original, first and joint inventor (if plural names are listed below at 201-205) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Method and Device for Demounting/Remounting Hammers, Hammer Axles and./or Protective Caps of Rotors of Hammer Crushers

the specification of which (check one)

\_\_\_\_\_ is attached hereto

☒ was filed on 31 May 2000

under Serial Number PCT/DE00/01798 and was amended on \_\_\_\_\_  
(if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I list below any prior foreign application(s) for patent or inventor's certificate in respect of which foreign priority benefits are claimed under 35 USC 119; and any prior foreign application(s) for patent or inventor's certificate in respect of which such foreign priority rights are not claimed and which has a filing date before that of any application in respect of which such foreign priority benefits are claimed:

Application Number	Country	Filing Date (day, month, year)	Priority Claimed under 35 USC 119
199 27 765.6	Germany	17 June 1999	YES: <input checked="" type="checkbox"/> NO: _____
			YES: _____ NO: _____
			YES: _____ NO: _____

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below.

Application No.	Filing Date

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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DEX

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<b>205</b>	Family Name	First Given Name	Second Given Name
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<p>I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.</p>			
Signature of Inventor 201		<i>X Martin Haßler</i>	Date <i>8.01.2002</i>
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Signature of Inventor 205			Date

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